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# Proposed purse seiner/trawler designed with special attention to cargo handling

A. Sangolt

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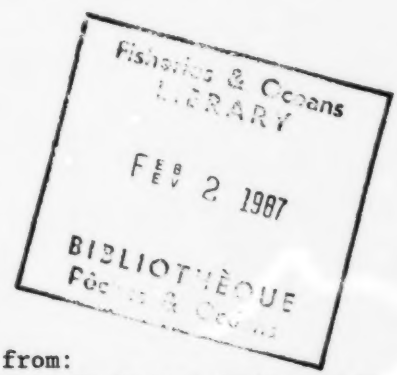


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PROPOSED PURSE SEINER/TRAWLER DESIGNED WITH SPECIAL ATTENTION TO CARGO HANDLING.

By Atle Sangolt.

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Reports, No 3, December 1979.

SUMMARY IN ENGLISH.

Page 34.

**Fishing vessel designed with special attention to cargo handling (Page 4)**

Most Norwegian fishing vessels have insufficient cargo handling equipment and discharging is frequently a time consuming and costly period employing as many as 6–8 men working 8–12 hours to unload 1000 tons (10.000 hl) of fish.

The article describes a combined purse seiner/-pelagic trawler where cargo handling has been given full attention and emphasis has been placed upon cargo preservation. The vessel is designed with RSW in all cargo tanks and the two hydraulic driven low RPM cargo pumps have a combined capacity of 400 $m^3/h$ (tons/h). The tanks are of self draining type and require no labouring below deck. Remote controlled cleaning and stripping systems are included.

3 of the 9 tanks (holds) have large hatches to facilitate easy handling of the refrigerated fish, while the cargo in the remaining 6 tanks are intended for reduction purposes. Spare room in the tween deck area aft and between deep tanks forward may be utilized for special treatment e.g. deep freezing of part of the catch.

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Page 4. As a partial project the Advisory Group for Unloading of Industrial Fish has drawn up a general layout and a brief specification for a combination vessel which is suitable for both seine netting and pelagic trawling. The cargo capacity is approximately 10 000 hectolitres (1 000 $m^3$) and considerations pertaining to cargo handling are given priority.

The consulting company Fiskerstrand and Eldøy in Ålesund were consultant engineers for the project. The vessel and fishing divisions of FTFI ( Research Institute of Fisheries Technology ) were consulted and a number of suppliers have contributed with advice and guidance. NSFI (Norwegian Institute of Shipping Research?) and "Det Norske Veritas" (Norwegian Ships Classification Authority) have provided useful corrections relating to some central points.

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1.5 - 2 million $m^3$ of fish are discharged annually at the Norwegian herring meal factories. Each of the roughly 1 000 cargo holds in the industrial fishing fleet are unloaded 15-20 times a year. The discharging is now essentially done with pumps, but grabs (claws) are also used. The factories attend to the unloading and are paid for this work. By negotiations between the parties it is in some instances possible for the shipping companies to arrange the discharging themselves with the revenues going to the fishermen, but this procedure is rarely used. Most fishing vessels are constructed without consideration for improving the efficiency of the unloading operations, and the available aids are limited. When compared with the remainder of the vessel, the degree of mechanization in the cargo hold area is not significant. The unloading of industrial fish continues to be a job which requires stevedores , even if their numbers can often be reduced as a result of the relief in working conditions which followed the introduction of the discharging pumps.

The discharging time is normally one to two hours per 1 000 hectolitres; it varies generally inversely proportionally to cargo volume, but season, fish species, age and degree of preservation affect the discharging time.

The authorities have restricted permission to unload during holidays, and waiting periods at the dockside are not uncommon because of the restrictive rules relating to working hours imposed on the stevedores.

The work carried out by the stevedores in the cargo holds of industrial fishing vessels is unpleasant; it is often heavy and not without danger.

It was against this background that the Advisory Group for Unloading of industrial Fish has arranged to draw up a general layout and a brief specification for a combination vessel which is suitable for both seine netting and pelagic trawling. The cargo capacity is approximately 10 000 hectolitres, and considerations relating to cargo handling are given priority.

(Superstructure) installations forward, spaceous working deck, large carrying capacity and good stability.

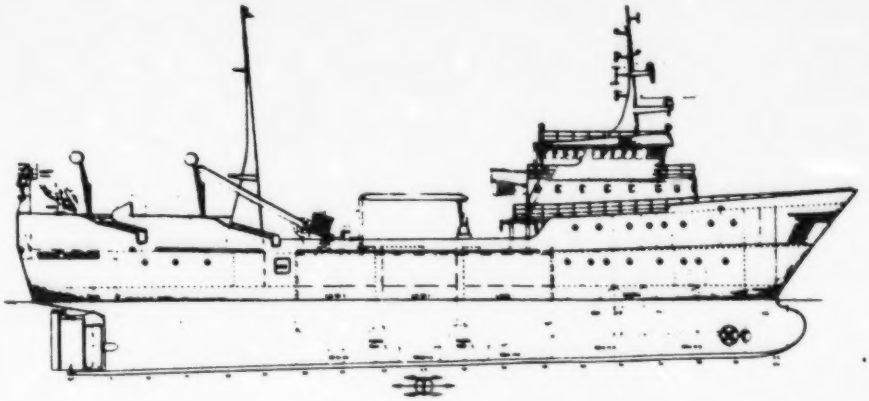
The general layout (fig. 1) shows a vessel with an overall length of 58.80 meters, a width of 12.00 meters and a moulded depth to the shelter-deck of 7.60 m; draft 6.00 m. All installations (furnishings) are placed forward and the vessel has an open working deck over a large portion of its length.

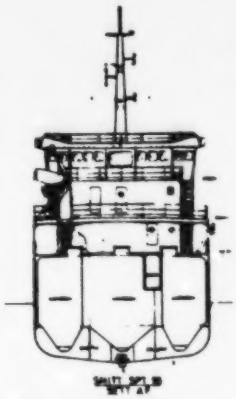
The deck machinery includes trawl winches, net drums, purse seine winch, seine winch, net rollers, line winches (?) and cranes; the layout permits conversion from purse seining to trawling within a very short time. Both the cargo carrying capacity and the stability will make it possible to carry duplicate sets of gear of each type without limiting the carrying capacity. The vessel will merit the highest classification in a recognized classification society and will generally comply with all safety requirements applying to this type of fishing craft. Its tonnage will be approximately 700 gross register tons.

The length/width ratio Lpp/B = 4.12 is lower than for most modern purse seiners; this is based on a desire to obtain improved initial stability and a good extension of the GZ curve in a loaded condition and with full equipment. The vessel draws as much water as comparable purse seiners and it will be capable of discharging at almost all factories. With a view to obtaining a central location of the cargo hatches and midships placing of the cargo tanks, all equipment and superstructures were located forward. This makes it possible to obtain a suitable placing of the deck equipment, a large trawl deck area and the required area for two seine net bins of 80 and 90 $m^3$ respectively on the shelterdeck. Experience with modern combination vessels shows that it is advantageous to have sufficient space on the trawldeck for installing the gear in the most suitable fashion.

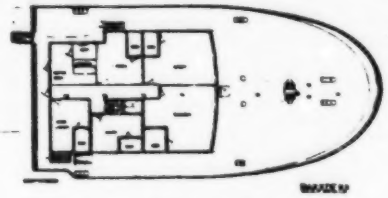
Propulsion and Manoevring.

Space is provided for a main engine of 1 800 - 2 200 kW (2 500 - 3 000 BHP)

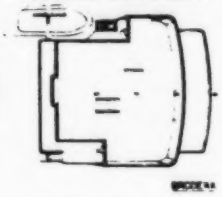




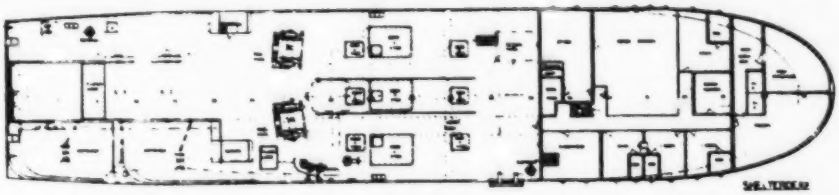
Section SPT 55
viewed from aft



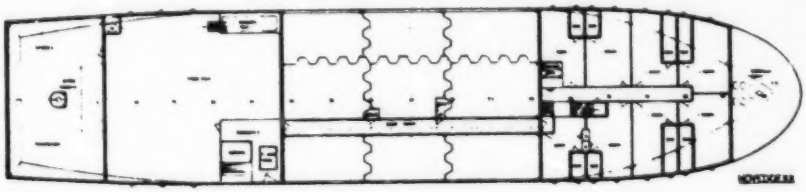
Forecastle deck



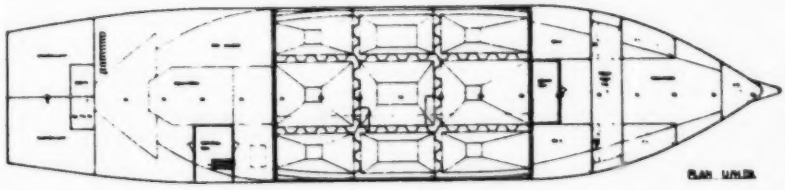
Bridge deck



Shelter deck

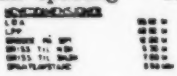


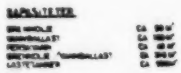
Main deck



Principal Dimensions

| | |
|---|---|
| L.O.A. | 58.00 m |
| L.P.P. | 49.50 m |
| Width at SPT. | 12.00 m |
| Depth to main deck | 5.30 m |
| to shelter deck | 7.60 m |
| Frame spacing | 550 mm |





Capacities

| | | |
|---|---|---|
| Bunker oil | approx. | 90 m³ |
| Water ballast | " | 100 m³ |
| Fresh water | " | 40 m³ |
| Bunker oil/ water ballast | " | 310 m³ |
| Cargo tanks | " | 950 m³ |

Advisory Group for Unloading of Industrial Fish, Bergen

PURSE SEINER/TRAWLER

GENERAL LAYOUT 5692-01

Fiskerstrand & Eldøy

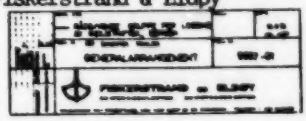


*Fig. 1. Generalarrangement.* General Layout

which makes it possible to trawl with heavy gear in deep water. The designed speed when loaded is 16 knots. A reversible propeller in a jet (nozzle) with
Page 7. Becker rudder will provide acceptable manoevring conditions , even if the trawl gallows are placed right aft, such as is the case. The propeller jet, which has not become as common in the fishing fleet as could perhaps be expected, will contribute to an improved operating economy in connection with trawling. It will, together with the bulb in the bow, reduce pitching in a headsea and also damp noise from the propeller and in this way increase the sensitivity of the fish-locating equipment. During loading operations from the trawl, the nozzle protects the propeller from the trawl bag which at that time is lying around the stern pointing forward along the starboard side of the vessel.

The transverse propeller aft is an installation which has gradually become common on purse seiners but it is expensive with very short operating times and considerable disadvantages with regard to price, space requirements and noise. The tunnel creates furthermore disturbances in the streamline flow field. The Becker rudder can turn the slipstream by 90° and makes the transverse propeller aft redundant since the required pushing force transverse to the vessel can be generated by the propulsion equipment, without creating a risk of getting nets into the propeller or other operational disturbances.

The general layout indicates that a design for the bow propeller tunnel of the so-called "K-jet" type is planned for the vessel. The advantage is a significantly higher pushing force per kW installed effect, when the vessel moves forward. The reason is better flow of water to the propeller, and the installation is only insignificantly more expensive than the conventional design. The bow propeller, which will have a power output of 450 kW (approximately 600 HP), will provide a significant contribution to steering under difficult trawling conditions.

Pleasant interior structures for the crew.

Space is planned for 16 men in single cabins with bath/WC, and spacious accommodations have been arranged on the shelter deck. In most operating modes and on most fishing grounds, the crew will be 13-14 men and it is open to discussion whether the number of cabins can be reduced by two. Owners of Norwegian fishing vessels have to a greater extent than foreign owners been reluctant to locate the interior structures forward. It is obvious that this involves greater accelerations for the crew than in accommodations located aft but it may also provide advantages such as a lower level of noise, improved safety and easier access to the various departments.

Roll damping tanks (so-called stabilizing tanks) are located in the bow below the main deck. The wheelhouse is designed without internal bulkheads to provide an unobstructed vision, and a vessel of this type will naturally be equipped with all customary communication and navigation aids and obviously only the best fish locating equipment.

The fishing vessel which is a tanker, a bulk carrier and a cold storage ship.

The cargo tank area with associated cargo handling equipment distinguishes the projected vessel most from existing fishing craft (See fig. 2). The lay-out includes nine tanks, each of which has a capacity of approximately 100 $m^3$ (1 000 hectolitres), and these are arranged midships in a 3x3 matrix.

The tanks are constructed with vertical corrugated bulkheads without stringers or other construction details which may obstruct loading and unloading. The design of the bottom is such that the tanks are self-emptying for fish without the use of mechanical aids in the cargo tanks and without a necessity for manual efforts to achieve this.

The bulkheads (both in the fore-and-aft direction and those transverse to the vessel) are placed on chair tanks with plane sloping sides which form inverted pyramids down toward the sole (discharging bilge well) with associated permanently installed discharging pumps. Apart from a small area in three of the tanks, there are no horizontal planes, and all planes slant toward the discharging bilge wells with a gradient of at least $30^{\circ}$. This is considered to be sufficient to achieve gliding between fish and bulkheads under all conditions. Since the cargo tanks are located where they are, it will always be possible to unload without problems due to large angles caused by trim or heeling over.

The rear hoops, which have gradually become common on ladders in cargo holds, create difficulties for an effective handling of cargo because large quantities of fish get stuck between the hoops and the rungs of the ladders during discharging operations. Rear hoops are therefore not appropriate, and the Maritime Directorate has no objections to this. The tanks are all insulated toward the sides and decks and they are equipped with RSW (Raw Sea Water) cooling for use with most common fish species. All tanks have drainage areas between the tops of the chair tanks and the shelter deck. The draining is usually carried out via the vessel's bilge pumping system. Permanently installed washing installations are planned in all cargo tanks, and cleaning operations can take place after completion of unloading and en route to the field. The washing installation with rotating washing cannon in each tank (fig. 3) will be equipped with a dosing pump for adding washing agents, and this will eliminate the need for manual work in the cleaning process. It is proposed to surface-treat the tanks with one of the modern paint

from 15°C to 0°C.

The compressor is located in the engine room, together with a condenser, a liquid level regulator and a cooling water line for the condenser. The cooling water line for the condenser has a return loop for recirculating cooling water from the heat exchanger.

The evaporator in each of the cold storage units is located on the main deck aft of the cargo tank area. This unit, which consists of an heat exchanger with gas container, requires a fair amount of space, and three of them together with the extensive pipe and valve system required in such a large installation, will occupy an area of approximately 15 $m^2$ of the entire between-deck level.

The circulation pumps for cooled sea water are of the non-selfpriming type and are therefore located low in the circulation system. A sea water filter with a by-pass line is installed behind each pump. The power requirement is approximately 10 kW per pump and the circulated volume at 100 kPa (1 $kp/cm^2$) is 210 $m^3/h$. The pumps can pump from tanks or sea chests and deliver to tanks or overboard.

The RSW installation is designed as three separate systems, which each consist of compressor, evaporator, condenser, circulating pump, valves, pipes and distribution arrangements. Each system has a main pipe on the pressure side (cooled sea water) and another on the return side. The three systems can be coupled together with pipe connections between the main lines. Each of the cargo tanks can be coupled to the pressure and return side so that the distribution plates in the bottom of the cargo tank are connected to the pressure side and the draining plate at the top of the tank is coupled to the suction side of the ciculating pump or vice versa. Within each group of tanks (three in each), a common overflow pipe is installed so that "used" sea water flowing to the top of the tank can be recirculated in the opposite direction in an adjacent tank.

Each of the three installations can deliver cooled sea water to any of the tanks, and they can (also) operate in parallel on a few tanks when the cooling requirements are great.

Since each tank is controlled via four valves, they can be dealt with individually, and if the fish in one tank tend to block up the draining plates at the top of the tank, the water flow in that tank can be reversed until conditions change, without affecting the other tanks.

systems which are available.

Consumers' merchandise and refrigerated industrial raw material.

The three tanks in the middle section are, in contrast to the pure industrial raw fish tanks, equipped with large hatches which permit the use of landing nets and possibly grabs. These tanks can be used for consumers' fish such as mackerel and blue whiting but are otherwise not distinct from the six other cargo tanks and can naturally also be used in industrial fishing. The volume is approximately 300 $m^3$ which means that close to 250 tons of consumers' merchandise can be landed.

Page 8

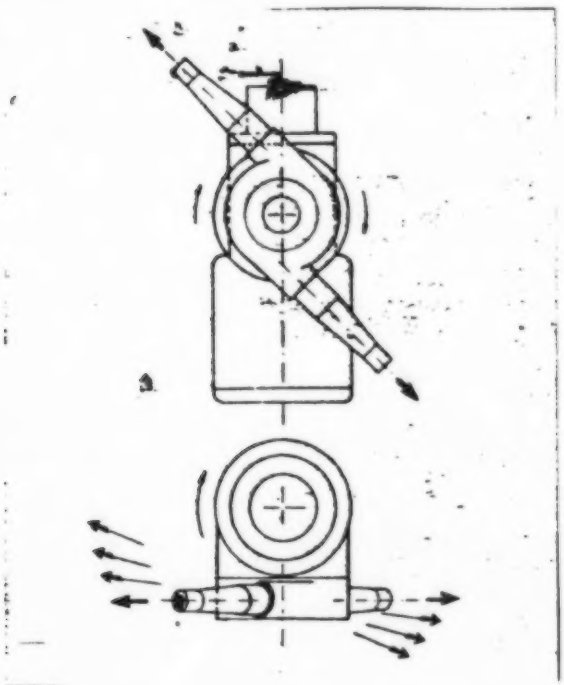
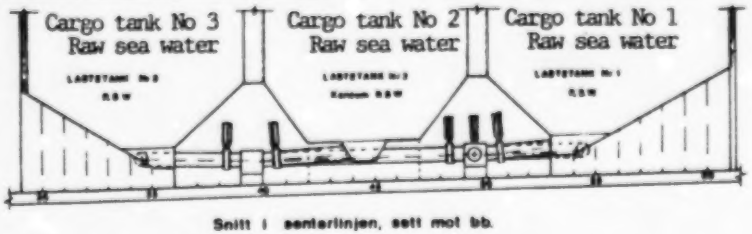


Fig. 3. Rotating washing cannon.

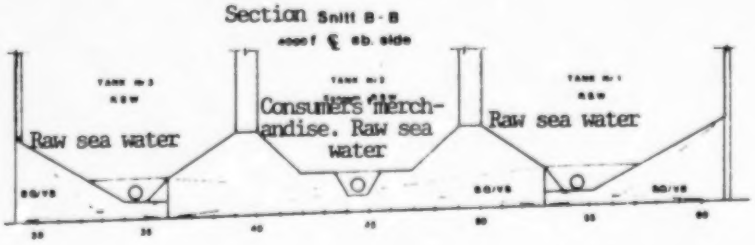
The RSW (Raw Sea Water) installation.

Each cold storage unit will consist of an 8-cylinder, single-stage Freon 22 machine with electric operation and a relief mechanism for an output reduction of 25, 50 and 75%. The total power requirement per unit including pumps will be approximately 75 kW and the produced cooling effect in the evaporator will be 217 kW. This is equivalent to (cooling) 106 tons of sea water in eight hours

Fig. 2. Lossearrangement.




Section in centre line, viewed toward bb



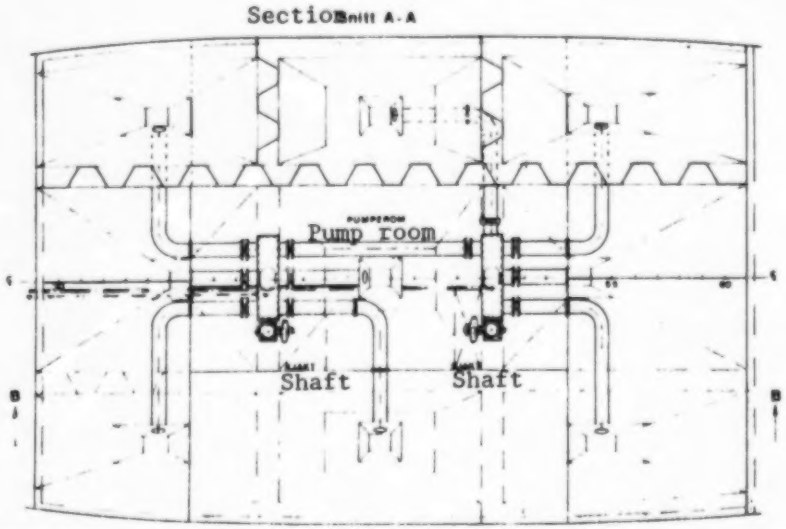
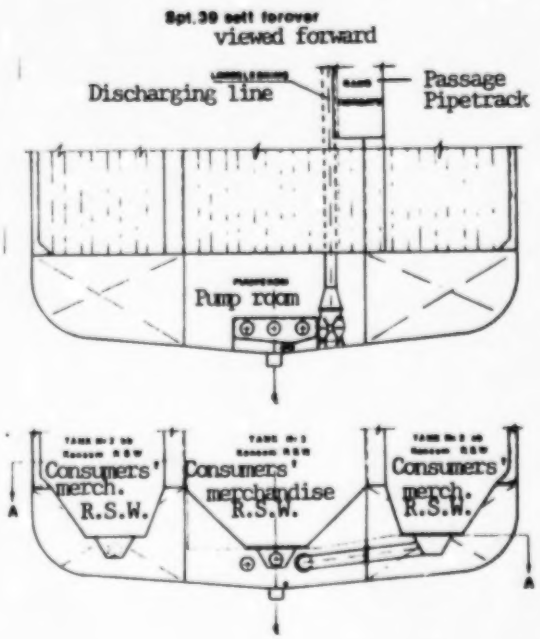




Fig. 2. Discharging arrangement




PURSE SEINER/TRAWLER

CARGO TANK ARRANGEMENT

DISCHARGING SYSTEM

SNURPER/TRÅLER.
ARR. I LASTETANKER
LOSSESYSTEM
ROFLAI OKT. 79

The RSW installation is dimensioned in such a way that the vessel will always be capable of landing first-class raw material for the industry and in many instances be able to benefit from consumers' deliveries, if it is correctly used, partly because an adequate cold reservoir is built up before the start of fishing operations. It is presupposed that the fish/water ratio is limited to reasonable values, e.g. 3:1, and that the cargo tanks are not drained and topped up with fish before the vessel leaves the fishing grounds, as is now the practice.

Fig.4. RSW (Raw sea water) arrangement.
*Fig. 4. RSW-anlegg. Rørarrangement sjøvannsiden.*

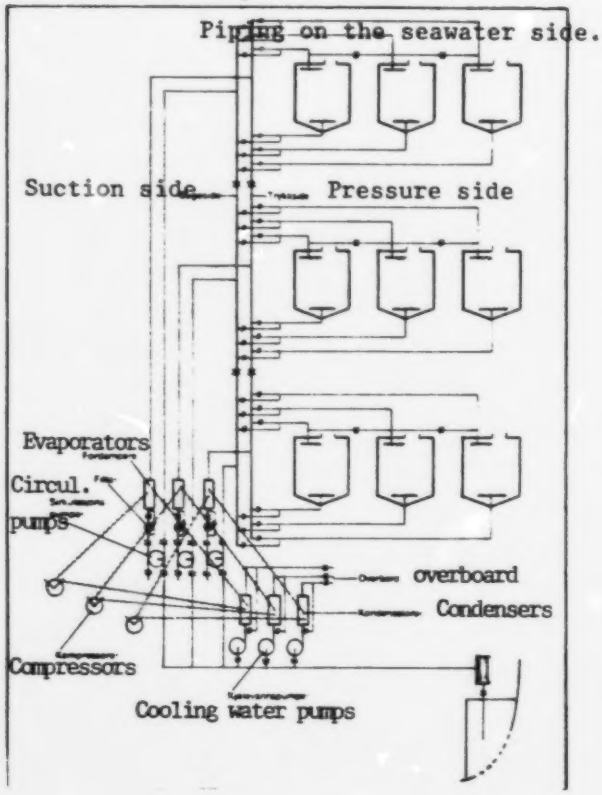



Fig.4. The RSW installation. Pipe diagram on the sea water side.

Page 9. Small hatches provide good working conditions on deck.

The six tanks reserved for industrial fish have hatches measuring 1 $m^2$. This is sufficient for loading fish and for access to the tanks for inspection and maintenance. The hatches are also large enough for the discharging pumps which are used by the factories to-day; mobile pumps can be used if a situation should arise where the vessels cannot unload the fish themselves with their permanently mounted unloading pumps. The small hatches are a definite advantage for work on

deck and they represent a positive contribution to safety on board. The hatches are installed symmetrically and make it a natural development to use an advanced draining and transport arrangement on deck.

Short unloading time.

Two Myrens BRP 15 pumps, each with a capacity of 200 $m^3$ per hour, are installed in the pump room which is located centrally in the double bottom. The pumps are operated hydraulically and their capacity can be regulated. They can operate in parallel and, including time for mooring and rigging, a full load (approximately 10 000 hectolitres) can be unloaded in three hours. In order to utilize the capacity it is assumed that the factory can receive and measure this quantity of fish; a number of plants are capable of doing so now. Each pump can pump out of any tank and deliver to the deck through its own discharging line. The pipe is 350 mm in diameter on the suction side and 300 mm on the pressure side. The suction lines are laid everywhere with a gradient toward the junction boxes to ensure good cleaning conditions. The installation is coupled to the bilge system to extract rinse water and residues. The valves are hydraulically operated sluice valves, and both the pumps, which have a variable speed, and the valves are operated from a centrally located control panel aft of the forecastle deck.

Apart from the obvious gain due to shorter unloading times it is the elimination of shore-based stevedores which determined the selection of the cargo handling equipment. To make a comparison, a 10 000 hectolitre boat of conventional type and with regular cargo holds without aids will require 8-12 hours for unloading, depending on the fish species, and during this time a team of 6-8 men would be employed.

Hidden reserves.

The drawing shows that the vessel has a large open space between the main deck and the shelter deck aft of the cargo tank area. This space is in addition to the storage space furthest aft which is intended for gear, equipment and perhaps spares of various kinds.

There is also relatively good space in the bow between the side tanks. These empty areas can be used for e.g.a capelin roe installation, plate freezers and freezing rooms; in this way the earning capacity of the vessel could be increased significantly. If the capelin roe freezing installation and the plate freezers were to be located aft and the freezing room in the bow, then it might perhaps be necessary to remove the aftermost cabin on the starboard side for

transportation reasons and install an elevator and a side port to discharge the merchandise as quickly as possible; otherwise there would be no need for large changes in the existing design for such an installation.

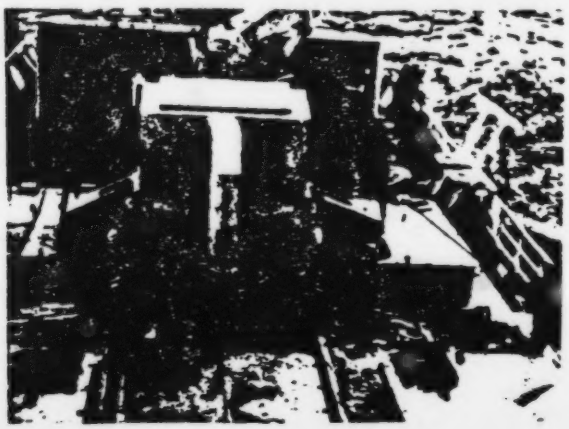
Large investment but increased earning capacity.

Much is done to improve the quality of the products developed from industrial raw material and to (ensure) that the fish is delivered in as fresh a condition as possible; such demands will likely become stronger as time goes by. Cooling of the raw material and gentle treatment during transportation and unloading will therefore be significant elements in the treatment of industrial fish in the future. Increased costs for the construction of the proposed fishing vessel, by comparison with a conventional purse seiner, are associated with the following elements:

- increased cold storage capacity and insulation of all cargo tanks,
- more complicated design of a double bottom in the cargo area,
- discharging pumps and lines with valves and control panel.

Altogether these items should not amount to more than 2-3 million Norwegian kroner and thus represent an increase in the construction price of approximately 7.5%.

On the revenue side the cost of unloading alone could amount to kroner 150 000 per annum. With a reduced discharging time and the end of dependence on stevedores it must be assumed that the value of a ship's cargo can be gained in each fishing season. One cargo will have a gross value of kroner 250 000-450 000, depending on the fish species, and the proposed investment has therefore a considerable potential rate of return. The most important arguments in favour of a deliberate investment in efficient cargo handling and quality-improving measures are, nevertheless, the increasing costs and difficulties which must be assumed to be associated with the present discharging method and not least the demands which will be made on products from the industry in the future.



Trackborne draining arrangement with distribution channels to the tanks.